Space Weather Technical Forecast

Issued on Sunday, 26 May 2024 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C5.8 at 25/1726 UTC which was likely from AR3679 over the southwest limb. A further C5.2 at 26/0936 UTC was observed from AR3691 in the northwest disc. This moderately sized region continued to show some slow growth in its northern periphery with a weak delta spot persisting within its northwest penumbra area. There are seven numbered sunspot regions on the disc however besides AR3691 these are all small and simple. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Background to slightly elevated solar winds speeds were observed by ACE at L1, varying between 350-450 km/s, with below average density. Interplanetary Magnetic Field (IMF), Bt, was weak, below 8nT, with the north-south component, Bz, also weakly varying between +5nT and -7nT, but mainly negative (southward). Phi angle was initially mainly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 (greater than 10 MeV) remained at Background. High energy electron flux (greater than 2MeV) at GOES16 was Background to Moderate with a peak of 231pfu at 25/1835 UTC. Associated 24-hour fluence remained below the Active threshold. Observed fluence at 26/0000 UTC was 3.72e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of isolated M-flares from AR3691 in the northeast. The return of hyperactive ex-AR3664 is also expected later in the period, maintaining this flare risk, although it is uncertain how much this has survived its far-side journey.

Solar Wind / Geomagnetic Activity: A weak CME glance is possible later day 1 or early day 2 (26-27 May), although confidence is low. This is due to a filament eruption from the southeast disc on 23 May. Weak fast wind influences are also possible, most likely day 2 and into day 3 (27-28 May) from the southern coronal hole CH40/+. Otherwise mainly background slow wind conditions are anticipated. Geomagnetic activity is forecast to be mainly Quiet, but perhaps increasing to Unsettled with a chance of Active intervals with any CME or fast wind arrival.

Energetic Particles / Solar Radiation: High energy proton flux is expected to be at background throughout. High energy electron flux is also forecast to persist at mainly background, The associated 24 hour fluence is expected to remain well below Active.

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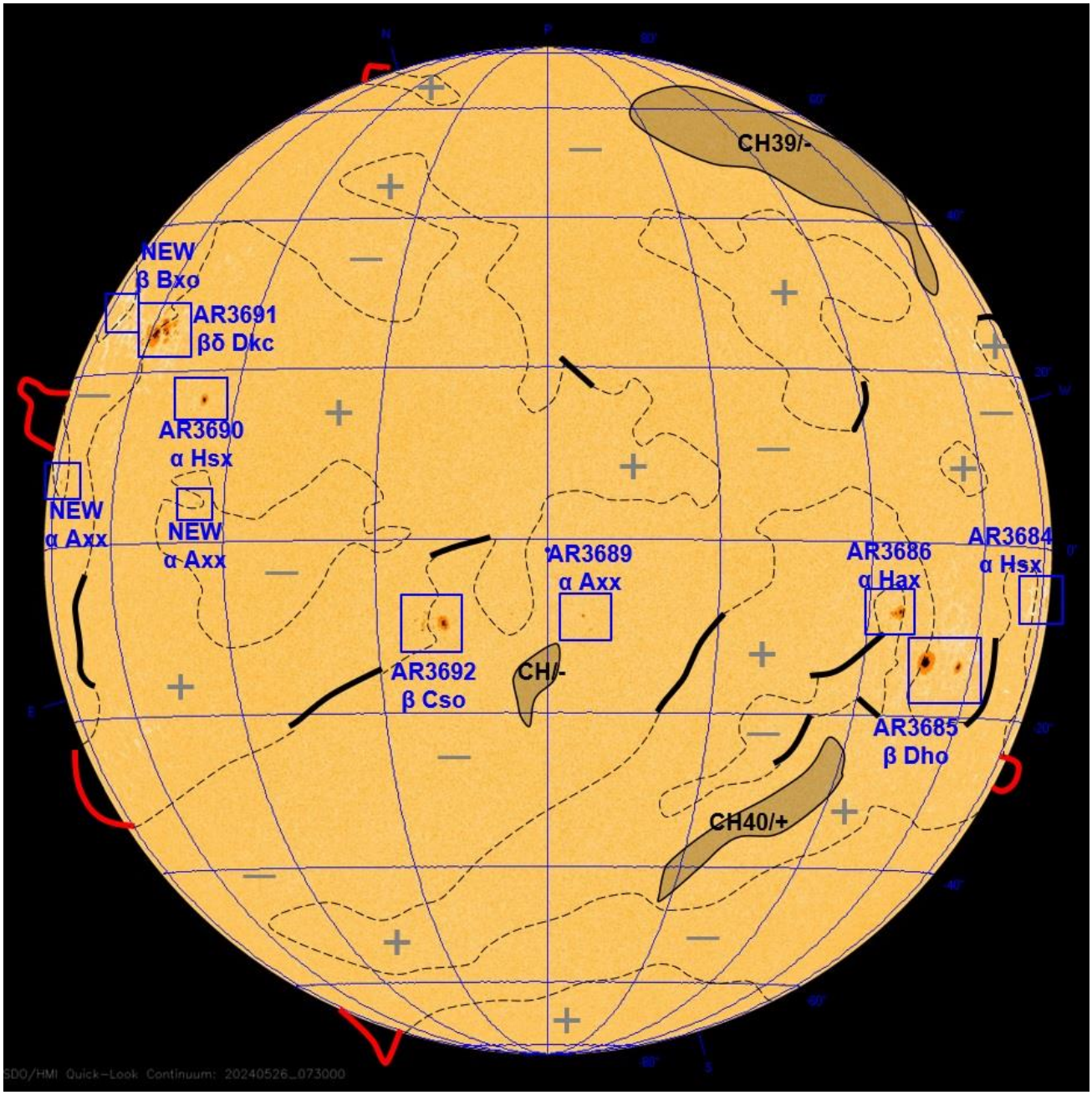
Figure 1. Solar Analysis Valid 26/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There is the potential for glancing impacts from a weak CME which left the Sun due to a filament eruption around 23/0600 UTC. This is low confidence, both due to its weak nature and due to imagery being contaminated with non-Earth-directed CMEs, however a weak arrival is indicated in MOSWOC Enlil late day 1 or early day 2 (26-27 May).

Otherwise, mainly background slow winds are expected to continue before the onset of any slight enhancement that may occur small CH40/+ situated in the southern disc. This brings a potential slight enhancement day 2 or day 3 (27-28 May), although any such enhancement is both low confidence and likely be limited, with solar winds quickly returning to background.

Mainly Quiet geomagnetic activity is expected, perhaps rising to give a spell of Unsettled to Active, with only a very slight chance of G1 Minor Storm with any CME arrival or coronal hole onset.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/1553	Partial	Filament	SE	320 km/s	27/0000 UTC +/- 12hrs	Low confidence. Glancing impact.

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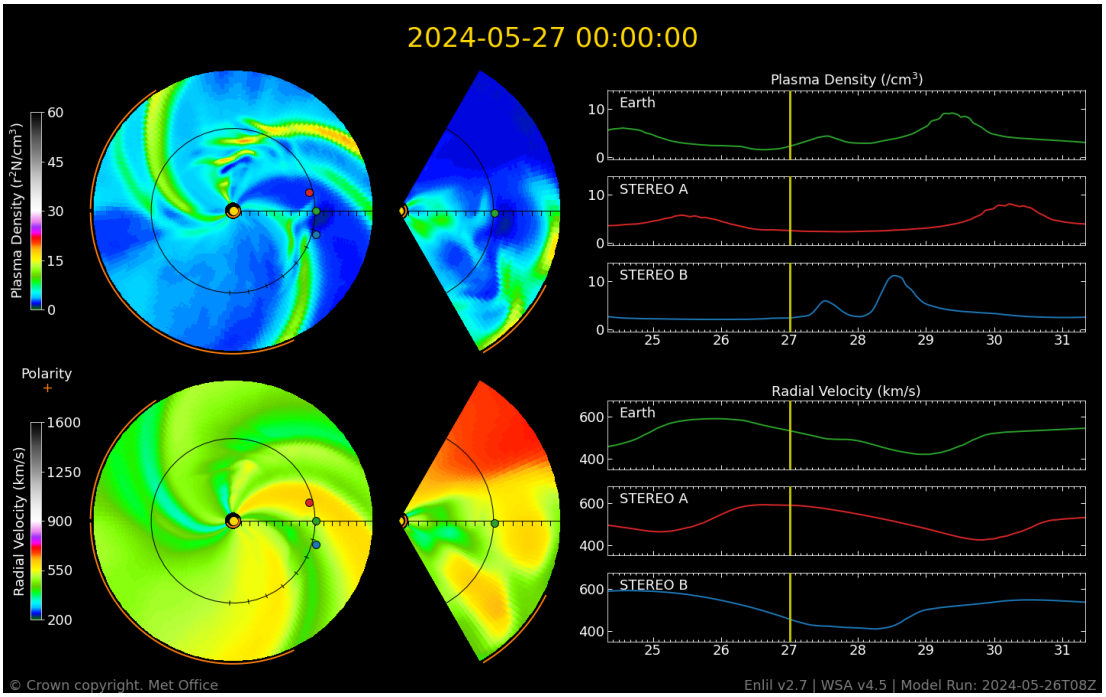
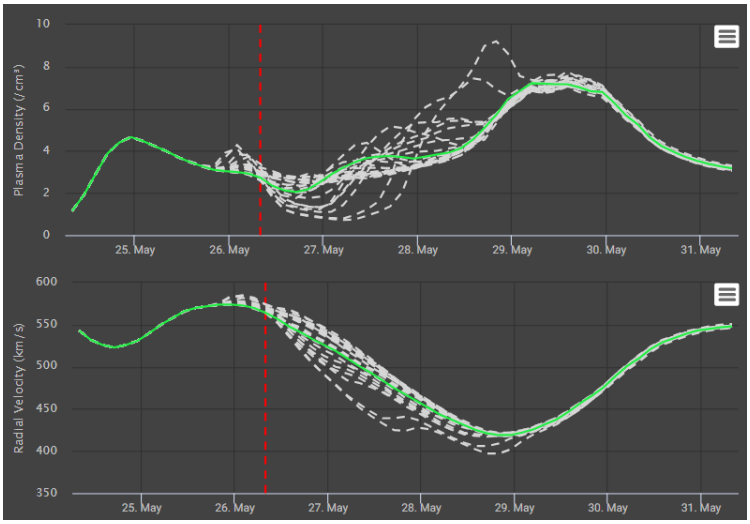
Figure 2: Enlil and ensemble





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Radio Blackouts - X-Ray Flares:

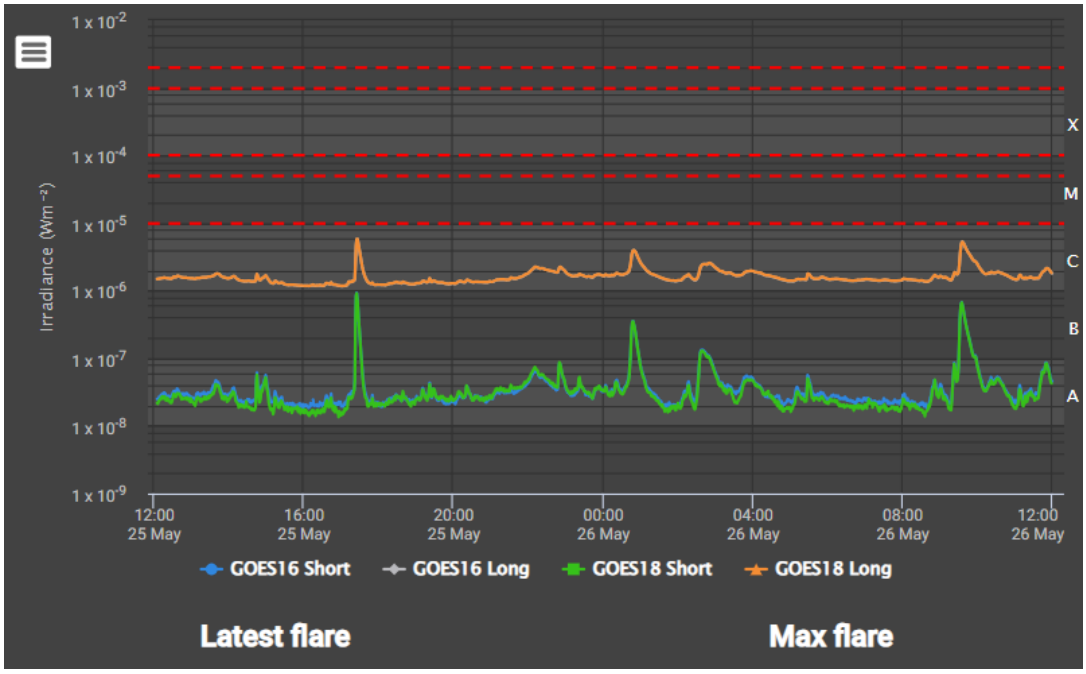
Low to Moderate activity, with an ongoing chance of isolated M-class flares and a slight chance of X-class flare, most likely from AR3691 but perhaps also from the return of ex-AR3664 as it moves onto the southeast limb.

Of the seven numbered sunspot regions, AR3691 in the northeast is the only notable one, with the others all currently small simple and stable. AR3691 has shown a recent developing phase, with growth to its northern periphery, although part of this might be due to an improving viewing angle. This is now a moderately sized region set within a larger area of plage, with some extensive magnetic looping also evident in SDO imagery and with its northwestern most penumbral extent showing a weak delta spot.

There is also the potential for activity to increase with the return of hyperactive AR3664 onto the southeast limb, most likely to occur through day 2 and into day 3 (27-28 May). While it remains uncertain how much of the region has persisted after its travels across the far-side, the magnetic canopy of the region is now becoming visible in SDO imagery. This brings any increasing potential for any notable flares to be observable from Earth.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: GOES 16/18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background, and expected to persist at these levels through the period. AR3691 is currently the most complex sunspot on the disc, but is located on the northeast disc. Subsequently this region is unlikely produced observable protons at Earth even given the occurrence of a notable flare, while the current activity on the west disc is unlikely to be sufficient for producing proton rich flares.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	2	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

GOES-16 electron flux is currently mainly background with only brief diurnal increases to Moderate possible. There is a slight chance of a weak connection to CH40/+ day 2-3 (27-28 May), and the potential for a weak CME glance later on day 1 or day 2 (26-27 May). These are both likely suppress the electron population at GEO on onset, with little enhancement following.

The associated 24 hour electron fluence is expected to remain below the Active level, as supported by MOSWOC REFM, which is currently providing good guidance for the expected trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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